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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/370,406	08/09/1999	JONATHAN FOOTE	FXPL-01003US	8078

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EXAMINER

TILLERY, RASHAWN N

ART UNIT	PAPER NUMBER
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2612

78

DATE MAILED: 07/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/370,406

Applicant(s)

FOOTE ET AL.

Examiner

Rashawn N Tillery

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-8,10-26 and 28-31 is/are pending in the application.
- 4a) Of the above claim(s) 17-19 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28-30 is/are allowed.
- 6) ☒ Claim(s) 1,4-8,10,13-16,20-24 and 31 is/are rejected.
- 7) ☒ Claim(s) 11,12,25,26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments, see page 12, filed May 6, 2004, with respect to the prior art references failing to disclose applying a bilinear transformation to selected pixels have been fully considered and are persuasive. The previous rejection has been withdrawn.

Because of the Examiner failed to meet all the limitations of the claims in the previous office action, the following action will be Non-Final.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1, 4-6, 10, 13-16 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski et al (US6044181) in view of Okitsu (US6188800).

Regarding claims 1 and 31, Szeliski discloses a method comprising:

synchronously capturing a set of images from a camera array (see col. 8, line 49 to col. 9, line 58);

selecting pixels from at least one image of the set of images (see col. 11, lines 1-12);

applying a planar transformation to the selected pixels to transform the selected pixels from a coordinate system of the at least one image to a common coordinate system of a composite image (see col. 10, line 9, line 59 to col. 11, line 11; Szeliski teaches combining two images taken at different viewpoints and computing a planar perspective transformation between each overlapping pair of the images).

Szeliski does not expressly disclose applying a bilinear transformation to the selected pixels. Okitsu teaches a two-dimensional spatial transformation system. Okitsu reveals, in figure 24A-D, that it is well known in the art to apply a bilinear transformation to overlapping portions of images to produce a composite image (see col. 20, line 5 to col. 21, line 21). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Szeliski's device by implementing Okitsu's teachings. One would have been motivated to do so in an effort to produce a composite image with a simple hardware configuration and reduced cost.

Regarding claim 4, Szeliski discloses identifying a set of contiguous patches in each of the images (see col. 17, lines 10-46).

Regarding claim 5, Szeliski discloses identifying regions in each image having registration points in common with the composite image (see col. 20, lines 34-60).

Regarding claim 6, Szeliski discloses combining patches from different images of the set of images having a same set of registration points into a same corresponding location of the composite image (see col. 24, lines 11-44).

Regarding claim 10, the combination of Szeliski and Okitsu disclose applying a predetermined bilinear transformation matrix to each patch, the predetermined bilinear

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transformation matrix representing an amount of warping required for each patch to transform each patch into the common coordinate (see col. 11, lines 1-12; also see col. 8, lines 49-67).

Regarding claim 13, Szeliski discloses repeating the step of applying a transformative equation for each set of images synchronously captured by the camera array, each set of images representing one frame in a video stream of the scene (see col. 10, lines 2-6).

Regarding claim 14, Szeliski discloses selecting an area of interest from the composite image; and outputting the selected area of interest to a user (see figure 18).

Regarding claim 15, Szeliski discloses the step of outputting comprises the step of displaying the area of interest from the combined warped images (see figure 2B).

Regarding claim 16, Szeliski discloses directing the area of interest to a predetermined area surrounding the proximity of objects detected in the scene (the examiner notes that Szeliski "area of interest" is the overlapping region).

2. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski et al and Okitsu in view of Harding (US5966177).

Regarding claim 7, Szeliski discloses warping patches from different images having a same set of registration points into a same corresponding location of the composite image. Neither Szeliski nor Okitsu expressly disclose cross-fading patches. Harding teaches an image display apparatus capable of blending multiple single display images together. Harding further teaches that it is well known in the art to correct intensity in an overlapped region of display images using a fading technique (see col. 3,

lines 1-29; also see col. 4, lines 41-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement Harding's teachings. One would have been motivated to do so in an effort to display image data of the correct intensity in an overlapped region.

Regarding claim 8, see claim 7 above.

3. Claims 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley (US5657073) in view of Szeliski et al in further view of Okitsu.

Regarding claim 20, Henly discloses, in figure 3, a camera array comprising:
a set of cameras mounted in an array (10; see col. 4, lines 22-33);
an image combining mechanism (16) configured to combine at least two of images captured from the set of cameras into a composite image (see col. 4, lines 34-57), the combining mechanism including:

a view selection device (20, 22) configured to select a view from the composite image (see col. 4, lines 34-57); and

an output mechanism (24) configured to display (30) the selected view.

Henley does not expressly disclose a warping device configured to warp patches by applying a bilinear transformation. Szeliski discloses warping patches from different images having a same set of registration points into a same corresponding location of the composite image. Szeliski does not expressly disclose applying a bilinear transformation. Okitsu teaches a two-dimensional spatial transformation system. Okitsu reveals, in figure 24A-D, that it is well known in the art to apply a bilinear transformation to overlapping portions of images to produce a composite image (see

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col. 20, line 5 to col. 21, line 21). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Szeliski's device by implementing Szeliski and Okitsu's teachings. One would have been motivated to do so in an effort to produce a composite image with a simple hardware configuration and reduced cost.

Regarding claim 22, Henley discloses the frame selection device includes a stereoscopic ranging mechanism configured to utilize at least two images from separate cameras of the camera array to determine a range of objects in the composite image (see col. 4, line 61 to col. 5, line 12; the Examiner notes that Applicant's claim language is written in the alternative).

4. Claims 21, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley and Szeliski and Okitsu in view of Harding.

Regarding claim 21, Henley discloses combining image data from multiple cameras. Neither Henley nor Szeliski nor Okitsu expressly disclose a fading device. Harding teaches an image display apparatus capable of blending multiple single display images together. Harding further teaches that it is well known in the art to correct intensity in an overlapped region of display images using a fading technique (see col. 3, lines 1-29; also see col. 4, lines 41-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement Harding's teachings. One would have been motivated to do so in an effort to display image data of the correct intensity in an overlapped region.

Regarding claim 23, the combination of Henley and Szeliski disclose the array of cameras are immovably mounted on a firm base (housing 12 in figure 2 of Henley); and

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the warping device applies a pre-determined transformation to each of the patches (Szeliski teaches a planar transformation).

Regarding claim 24, the combination of Henley and Szeliski disclose a registration mechanism configured to register each of the camera arrays by finding registration points in common with views of each camera and the composite image (Szeliski teaches finding registration points only in overlapping regions of combined images).

Allowable Subject Matter

1. Claims 28-30 are allowed.

Regarding claim 30, the prior art does not teach or fairly suggest a method of registering a camera array comprising placing at least one registration point in a field of view of at least two cameras, identifying a location of each registration point and maintaining information about each registration point, wherein

the step of maintaining information comprises calculating a warped coordinate system and maintaining a table identifying pixels of the cameras, an amount of fade, and a corresponding location in the warped coordinate system.

2. Claims 11, 12, 25 and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 11, the prior art does not teach or fairly suggest a method of warping a set of images into a common coordinate system of a composite image by

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cross-fading patches from different images having a same set of registration points, wherein

the step of cross-fading comprises the steps of varying a parameter of each pixel from a minimum value a first and second patch to a maximum value of the first and second patch, respectively, summing each of corresponding pixel values of each first and second patch and placing the summed values in corresponding locations of the common coordinate system.

Regarding claim 25, the prior art does not teach or fairly suggest a camera array comprising a set of cameras mounted in an array, an image combining mechanism, a view selection device, an output mechanism and a registration mechanism, wherein

the registration mechanism comprises a registration point source and a detection mechanism.

Conclusion

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Aiger et al teach a method of mosaicing using affine or bilinear transformation. Nakaya et al teach a synthesizing method using bilinear transformation.
2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rashawn N Tillery whose telephone number is 703-305-0627. The examiner can normally be reached on 9AM-6:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on 703-305-4929. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RNT


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PRIMARY EXAMINER